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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/944,508	08/30/2001	Warren M. Farnworth	3393.6US (97-324.6)	4342

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EXAMINER
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FULLER, ERIC B

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 04/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/944,508

Applicant(s)

FARNWORTH, WARREN M.

Examiner

Eric B Fuller

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Request for Continued Examination*

The Request filed on March 17, 2003 for Continued Examination (RCE) under 37 CFR 1.114 based on parent Application No. 09/944,508 is acceptable and an RCE has been established. An action on the RCE follows.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1).

Watts teaches a process where a continuous stream of charged solder droplets is produced (column 3, lines 40-45). Heaters are used to melt the solder in the reserve and maintain it in the liquid state while being ejected (column 3, lines 55-65). A piezoelectric crystal vibrator is used to induce a standing pressure wave on the solder, thus producing droplets (column 3, lines 50-55). When ejected, a charge is selectively applied to the solder droplets (column 4, lines 10-12). A bias is used to deflect some of the droplets in a certain dimension and onto a substrate (column 4, lines 15-30).

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Additionally, some of the droplets are prevented from reaching the substrate as they are passed undeflected into a gutter. The deflection is programmably controlled (column 4, lines 13-34).

As to claim 1, the reference fails to teach that the deflection occurs in a first and second dimension. However, it is taught in figure 1 that a pair of deflection plates (16,18), situated to be perpendicular to the Y-axis, is used to deflect the solder in the Y direction while the substrate is moved in the X direction. One of ordinary skill in the art would recognize, from the teachings of Watt, that the addition of two more deflections plates, that are perpendicular to the X-axis, would allow one to deflect the solder droplets in the X direction as well. This is merely a duplication of parts. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to deflect the solder of Watts in two dimensions as opposed to only one. By doing so, the need for substrate movement may be eliminated, resulting in less energy requirements, and/or the droplet placement is more easily and accurately controlled. Additionally, more areas of the substrate are able to receive solder (as will be discussed in the response to arguments section).

As to claim 2, it is the position of the examiner that the heaters that heat the solder in the supply chamber act to control the temperature of the solder.

As to claim 6, since both the present invention and the reference teach using the apparatus for ejecting solder droplets onto a printed circuit board, and the method of producing the droplets that is taught by the reference is the same as that of the applicant's claim, it is the position of the examiner that the diameter of the solder

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droplets of the reference would be inclusive of the range that is claimed by the applicant.

As to claim 7, the reference teaches that the desired pattern determines whether the droplets are caught by the gutter (blanked) or allowed to reach the substrate (column 7, lines 40-50). Figure 1 shows horizontal lines being produced, wherein the absence of solder between the endpoint of the previous horizontal line and the starting point of the next horizontal line shows that it is not desirable to have solder between these two points. Therefore, it would have been obvious to one skilled in the art to blank the solder stream when the stream is positioned between these two points.

As to claim 8, examiner admits that Watts teaches that it is the undeflected droplets that are blanked. However, it is the examiner's position that to allow the droplets to fall undeflected into a gutter that is positioned directly under the stream or to deflect the stream into a gutter that is positioned slightly away from directly under the stream are functionally equivalent to each other, as both act to prevent solder from reaching the substrate. To use either method would have been obvious at the time the invention was made to a person having ordinary skill in the art with a reasonable expectation of success.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1), as applied to claim 3 above, and further in view of Nakasu et al. (US 6,213,356 B1).

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Watts teaches the limitations of claim 3, as shown above, but fails to teach that separate piezoelectric crystals generate the pressure inducing step and the vibration step. Watts does teach to use a piezoelectric crystal for the vibration step (column 3, lines 50-55). Nakasu teaches to use of a piezoelectric crystal when pressurizing a supply of solder in order to increase consistency of the droplets being ejected (column 2, lines 36-61). Therefore, to have a second piezoelectric crystal control the pressure of the supply chamber in Watts would have been obvious at the time the invention was made to a person having ordinary skill in the art. By doing so, the consistency of the drop formation is increased. The diameter of the drop is read upon by Watts as shown above with respect to claim 6.

### ***Response to Arguments***

Applicant argues that there is support in the specification for the limitations of claim 2, as it has been currently amended. Examiner agrees and has withdrawn the rejection to claim 2 that was based on 35 USC 112.

Applicant argues that there is no suggestion in Watts that one would have been motivated to deflect droplets in two dimensions as opposed to only one. This is not found persuasive. The examiner notes that one of ordinary skill in the art would at least possess the knowledge and education of a design engineer, such as at least a bachelor's degree in engineering that included courses in electromagnetism, particle dynamics, and fluid dynamics. *Mueller Brass Co. v. Reading Industries* 176 USPQ 361,369, teaches that ordinary skill in the art is the level of skill of those who normally attack the

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problems of the art that counts. Persons who do most of the problem solving in involved art are graduate engineers, and as such they are chargeable with the general knowledge concerning principals of engineering, outside the narrow field involved, and with skills, ingenuity, and competence of an average professional engineer.

Watts clearly provides a teaching that a pair of deflection plates, arranged perpendicularly to the Y-axis, provides deflection in the Y-axis. Just as one pair of plates is used to control drop placement, one having the ordinary knowledge and ingenuity of an engineer would recognize that additional pairs of plates would allow for greater control of drop placement. From the teaching of plates arranged on the Y-axis providing deflection in the Y direction, an ordinary engineer would have the capacity to expand this to an additional pair of plates arranged on a different axis to provide displacement on that axis. To do so is merely a duplication of parts. It has been established that duplication of parts is held to be obvious. *St. Regis Paper Co. v. Beemis Co. Inc.* 193 USPQ 8, 11 (1977); *In re Harza* 124 USPQ 378 (CCPA 1960).

Additionally, the examiner has provided motivation for the duplication of parts in stating that deflection in two directions would eliminate the need for substrate movement. In support of this, it is noted that the applicant has stated in the paragraph spanning pages 8 and 9 of the remarks that because the substrate and the translation mechanism are much heavier than the droplets, positioning the droplets at a target is done more quickly and requires much less energy than moving the target. This concept of lighter objects requiring less energy to move than heavier objects (moving the droplet versus moving the substrate) is well within the scope of knowledge of a graduate

engineer and is the basis for why eliminating substrate movement is a benefit.

Therefore, elimination of substrate movement, in order to use less energy, is sufficient motivation for one skilled in the art to have droplet deflection in two directions.

Watts teaches all the limitations of the applicant's claim, absent providing deflection in two dimensions. Regardless if substrate movement is eliminated or not, one with the knowledge of an engineer would recognize that multiple pairs of plates would allow for more control than a single pair of plates. To have multiple pairs of plates would therefore have been obvious to one of skill in the art in order to reap the benefit of increased placement control.

Applicant argues that Watts would be practically inoperable with the modification suggested because areas below the gutter could not receive solder once the modification is made. This is not found persuasive. Watts does not teach that solder is deposited below the gutter. Therefore, the process of Watts could indeed be performed successfully with the modification made. In fact, Watts, by using substrate movement in only the X direction, is hindered in which areas the substrate may receive solder. From Watts, not only is it impossible to place solder in areas located underneath the gutter, but it is also impossible to place solder in areas that are in line with the gutter in the direction of motion. By providing deflection in two directions, as opposed to having only substrate movement, the areas located above and below the gutter along the X-axis are capable of receiving solder. Therefore, the proposed obvious modification of having deflection in two directions provides an additional benefit of allowing solder to reach more areas of the substrate than is otherwise achievable by single direction deflection



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alone. As even more areas of the substrate are able to receive solder after the obvious modification is made, the modification clearly is operable and provides an additional benefit that is obvious to one of ordinary skill in the art.

Applicant argues that Watts fails to teach that the temperature of the solder in the reservoir is controlled. This is not found persuasive. Watts teaches that the solder is heated to a desired temperature in the supply chamber (column 5, lines 20-25). Heating something to a desired temperature is the equivalent of controlling the temperature.

All other arguments pertain to points made above and apply to the arguments applicant has made of Watts in view of Nakasu. Accordingly, the rejections are maintained for the same reasons.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Mondays through Thursdays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck, can be reached at (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and (703) 872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



EBF

April 23, 2003



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